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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/464,322	12/15/1999	HEUNG-KYU KWON	AB-881US	7367
30593	7590	11/16/2006	EXAMINER	
HARNESS, DICKEY & PIERCE, P.L.C.			CHU, CHRIS C	
P.O. BOX 8910			ART UNIT	
RESTON, VA 20195			PAPER NUMBER	
			2815	

DATE MAILED: 11/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/464,322

Applicant(s)

KWON ET AL.

Examiner

Chris C. Chu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply.

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 October 2006.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 2 - 15 and 17 - 20 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 2 - 15 and 17 - 20 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 28 June 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Request for Continued Examination***

1. A request for continued examination (RCE) under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 23, 2006 has been entered. An action on the RCE follows.

### ***Response to Amendment***

2. Applicant's amendment filed on September 14, 2006 has been received and entered in the case.

### ***Drawings***

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the following limitation in claim 8 "the heat slug comprises a solder bonding layer formed on a surface of the heat slug that contacts the solder film" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

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4. Applicant is required to submit a proposed drawing correction in reply to this Office action. However, formal correction of the noted defect may be deferred until after the examiner has considered the proposed drawing correction. Failure to timely submit the proposed drawing correction will result in the abandonment of the application.

On page 7, applicant argues “applicants assert that the objection is now moot given the Applicants amendments to the drawings as attached.” This argument is not persuasive because the attached drawings have not been received in the case. Thus, the objection of the drawing is maintained.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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7. Claims 3, 5, 6, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa et al. (U. S. Pat. No. 5,592,735) in view of Akasaki et al. (U. S. Pat. No. 5,217,922).

Regarding claim 3, Ozawa et al. discloses in Fig. 14 a semiconductor chip package comprising:

- a substrate (41) having a plurality of bonding pads;
- a semiconductor chip (32-2) having a plurality of conductive bumps on a front side thereof, the conductive bumps contacting the bonding pads;
- a heat slug (36) bonded to a backside of the semiconductor chip; and
- a solder film (144) directly attached to the heat slug (36) thereby bonding the heat slug to the backside of the semiconductor chip,
- wherein the backside of the semiconductor chip includes a solder bonding metal layer (33-2) "in contact with" and between the semiconductor chip and the solder film.

Further, the recitation "a plurality of bonding pads" is structurally inherent in Ozawa et al.

However, Ozawa et al. does not disclose a multi-metal layer film in contact with and between the semiconductor chip and the solder film. Akasaki et al. teaches in e.g., Fig. 2(F) a multi-metal layer film (15 – 17 or 9A; column 5, lines 49 – 62 and see e.g., Fig. 2(F)) in contact with and between a semiconductor chip (1; column 5, line 3) and a solder film (8; column 7, lines 20 and 21). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ozawa et al. by using the multi-metal layer film as taught by Akasaki et al. The ordinary artisan would have been motivated to modify Ozawa et al. in the manner described above for at least the purpose of increasing adhesion to the back of a silicone

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substrate without thermal damage to a BLM layer or a semiconductor element (column 2, lines 23 – 27).

Regarding claim 5, Ozawa et al. discloses in Fig. 14 a space between the semiconductor chip and the substrate being filled with an underfilling material (141).

Regarding claim 6, Ozawa et al. discloses in Fig. 14 the solder film (144) having a size equal to or larger than a size of the semiconductor chip (32-2).

Regarding claim 14, the method steps are disclosed by Ozawa et al. for the same reasons provided above with regarding claim 3.

Regarding claim 15, Ozawa et al. discloses in Fig. 14 filling a resin (141) into a space between the semiconductor chip and the substrate.

8. Claims 2 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa et al. and Akasaki et al. as applied to claim 3 above, and further in view of Haley.

Regarding claim 2, Ozawa et al. and Akasaki et al. disclose the claimed invention except for the material of the solder film, which includes one selected from “a group consisting of Pb, Sn, Ag, In, and Bi.” However, Haley discloses in column 3, lines 66 –67 the material of a solder film. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Ozawa et al. and Akasaki et al. by selecting from a group consisting of Pb, Sn, Ag, In, and Bi for the material of the solder film as taught by Haley. The ordinary artisan would have been motivated to further modify Ozawa et al. and Akasaki et al. in the manner described above for at least the purpose of increasing the bond strength between the semiconductor chip and the heat slug.

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Regarding claim 13, Ozawa et al. and Akasaki et al. disclose the claimed invention except for a plurality of “throughholes” on the heat slugs. However, Haley discloses the plurality of “throughholes” on the heat slugs (108 and 109 in Fig. 1). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Ozawa et al. and Akasaki et al. by adding the plurality of “throughholes” on the heat slugs as taught by Haley. The ordinary artisan would have been motivated to further modify Ozawa et al. and Akasaki et al. in the manner described above for at least the purpose of decreasing moisture inside of the package.

9. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa et al. and Akasaki et al. as applied to claim 3 above, and further in view of Furukawa et al.

Ozawa et al. and Akasaki et al. disclose the claimed invention except for the material of the metal layer, which includes one selected from “a group consisting of VNi/Au, Ti/VNi/Au, Cr/Vni/Au, Ti/Pt/Au, and etc.” However, Furukawa et al. discloses the material of the metal layer (column 9, lines 63 –64). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further rmodify Ozawa et al. and Akasaki et al. by selecting from a group consisting of VNi/Au, Ti/VNi/Au, Cr/Vni/Au, Ti/Pt/Au, and etc for the material of the metal layer as taught by Furukawa et al. The ordinary artisan would have been motivated to further modify Ozawa et al. and Akasaki et al. in the manner described above for at least the purpose of increasing the bond strength between the semiconductor chip and the solder film.

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10. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa et al. and Akasaki et al. as applied to claim 3 above, and further in view of Takahama et al.

Ozawa et al. and Akasaki et al. disclose the claimed invention except that the heat slug is formed of a material selected from a group consisting of Cu, Al, and CuW. However, Takahama et al. discloses that the material of the heat slug (column 6, lines 38 – 39). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Ozawa et al. and Akasaki et al. by selecting from a group consisting as of Cu, Al, and CuW as taught by Takahama et al. The ordinary artisan would have been motivated to further modify Ozawa et al. and Akasaki et al. in the manner described above for at least the purpose of improving heat dissipation.

11. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa et al. and Akasaki et al. as applied to claim 3 above, and further in view of Myers et al.

Regarding claim 8, Ozawa et al. and Akasaki et al. disclose the claimed invention except for the heat slug comprises a solder bonding layer formed on a surface of the heat slug that contacts the solder film. However, Myers et al. discloses in Fig. 2 a heat slug (32) comprising a solder bonding layer (30) formed on a surface of the heat slug (32) that contacts a solder film (28). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Ozawa et al. and Akasaki et al. by using the solder bonding layer as taught by Myers et al. The ordinary artisan would have been motivated to further modify Ozawa et al. and Akasaki et al. in the manner described above for at least the purpose of spreading heat laterally (column 1, lines 64 ~ 66).



Regarding claim 9, Myers et al. discloses in column 1, lines 64 and 65 the solder bonding layer being a Ag layer.

12. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa et al. and Akasaki et al. as applied to claim 3 above, and further in view of Jeong et al.

Ozawa et al. and Akasaki et al. disclose the claimed invention except for the heat slug is coated with an anodizing layer on a surface of the heat slug that is opposite to another surface of the heat slug, on which the semiconductor chip is bonded. However, Jeong et al. discloses that an anodizing layer (73b in Fig. 6 and column 8, lines 2 – 5 and read column 7, lines 65 ~ 67) on a surface of a heat slug (73) that is opposite to another surface of the heat slug, on which the semiconductor chip is bonded (see Fig. 6). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Ozawa et al. and Akasaki et al. by using the anodizing layer as taught by Jeong et al. The ordinary artisan would have been motivated to further modify Ozawa et al. and Akasaki et al. in the manner described above for at least the purpose of increasing the corrosion resistant and electrical insulation.

13. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa et al. and Akasaki et al. as applied to claim 3 above, and further in view of Hawthorne et al.

Regarding claim 11, Ozawa et al. and Akasaki et al. disclose the claimed invention except for the heat slug being shaped such that a portion of the heat slug is attached to the substrate by an adhesive. However, Hawthorne et al. discloses in Fig. 3 the heat slug being shaped such that a portion of the heat slug (66) is attached to the substrate (40, 50a and 50b) by

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an adhesive (62). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Ozawa et al. and Akasaki et al. by using the shape of the heat slug as taught by Hawthorne et al. The ordinary artisan would have been motivated to further modify Ozawa et al. and Akasaki et al. in the manner described above for at least the purpose of increasing reliability of package.

Regarding claim 12, Ozawa et al., Akasaki et al. and Hawthorne et al. discloses the claimed invention except for the adhesive includes silicon rubber or elastomer. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to using silicon rubber or elastomer material for the adhesive, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. The ordinary artisan would have been motivated to further modify Ozawa et al. in the manner described above for at least the purpose of increasing the bond strength between the heat slug and the substrate. In re Leshin, 125 USPQ 416.

14. Claims 17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hawthorne et al. in view of Ozawa et al., and further in view of Akasaki et al.

Regarding claim 17, Hawthorne et al. discloses in Fig. 3 the solder film (71) has a size equal to or larger than a size of the semiconductor chip (44).

Regarding claim 19, Hawthorne et al. discloses in Fig. 3 a semiconductor chip package comprising:

- a substrate (40, 50a and 50b) having a plurality of bonding pads (see Fig. 3);

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- a semiconductor chip (44) having a plurality of conductive bumps (54) on a front side thereof, the conductive bumps (54) contacting the bonding pads (see Fig. 3);
- a heat slug (66) bonded to the semiconductor chip (see Fig. 3), the heat slug (66) comprising a top portion, side standing portions bent from the top portion, and side end portions bent again from the side standing portions (see Fig. 3); and
- a conductive solder film (71) that bonds the heat slug (66) to the backside of the semiconductor chip (see Fig. 3), wherein the heat slug (66) contacts the solder film (71) and the side end portions (70) of the heat slug (66) are attached to the substrate (40, 50a and 50b) by an adhesive (62 and see Fig. 3).

Hawthorne et al. does not disclose a solder bonding layer formed on a surface of the heat slug that contacts the solder film and the backside of the semiconductor chip includes a solder bonding metal layer in contact with and between the semiconductor chip and the solder film. However, Ozawa et al. discloses in Fig. 14 a heat slug (47) comprising a solder bonding layer (42) formed on a surface of a heat slug (47) that contacts (thermal contact) a solder film (144) and backside of a semiconductor chip (32-2) including a solder bonding metal layer (33-2) in contact with and between the semiconductor chip and the solder film. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hawthorne et al. by using the solder bonding layer and the solder bonding metal layer as taught by Ozawa et al. The ordinary artisan would have been motivated to modify Hawthorne et al. in the manner described above for at least the purpose of reducing thermal resistance and improving heat radiation (column 2, lines 19 ~ 22). Further, the recitation “a plurality of bonding pads” is structurally inherent in Hawthorne et al.

However, Hawthorne et al. and Ozawa et al. do not disclose a multi-metal layer film in contact with and between the semiconductor chip and the solder film. Akasaki et al. teaches in e.g., Fig. 2(F) a multi-metal layer film (15 – 17 or 9A; column 5, lines 49 – 62 and see e.g., Fig. 2(F)) in contact with and between a semiconductor chip (1; column 5, line 3) and a solder film (8; column 7, lines 20 and 21). It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Hawthorne et al. and Ozawa et al. by using the multi-metal layer film as taught by Akasaki et al. The ordinary artisan would have been motivated to further modify Hawthorne et al. and Ozawa et al. in the manner described above for at least the purpose of increasing adhesion to the back of a silicone substrate without thermal damage to a BLM layer or a semiconductor element (column 2, lines 23 – 27).

15. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hawthorne et al., Ozawa et al. and Akasaki et al. as applied to claim 19 above, and further in view of Takahama et al.

Hawthorne et al., as modified, discloses the claimed invention except that the heat slug is formed of a material selected from a group consisting of Cu, Al, and CuW. However, Takahama et al. discloses in column 6, lines 38 – 39 the material of the heat slug. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Hawthorne et al. by selecting from a group consisting as of Cu, Al, and CuW as taught by Takahama et al. The ordinary artisan would have been motivated to further modify Hawthorne et al. in the manner described above for at least the purpose of improving heat dissipation.

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16. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hawthorne et al., Ozawa et al. and Akasaki et al. as applied to claim 19 above, and further in view of Jeong et al.

Hawthorne et al., as modified, discloses the claimed invention except for the heat slug is coated with an anodizing layer on a surface of the heat slug that is opposite to another surface of the heat slug, on which the semiconductor chip is bonded. However, Jeong et al. discloses that an anodizing layer (73b in Fig. 6 and column 8, lines 2 – 5 and read column 7, lines 65 ~ 67) on a surface of a heat slug (73) that is opposite to another surface of the heat slug, on which the semiconductor chip is bonded (see Fig. 6). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Hawthorne et al. by using the anodizing layer as taught by Jeong et al. The ordinary artisan would have been motivated to further modify Hawthorne et al. in the manner described above for at least the purpose of increasing the corrosion resistant and electrical insulation.

### ***Response to Arguments***

17. Applicant's arguments with respect to claims 3, 14 and 19 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chris C. Chu whose telephone number is 571-272-1724. The examiner can normally be reached on 11:30 - 8:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on 571-272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Chris C. Chu  
Examiner  
Art Unit 2815

c.c.  
Monday, November 6, 2006



KENNETH PARKER  
SUPERVISORY PATENT EXAMINER